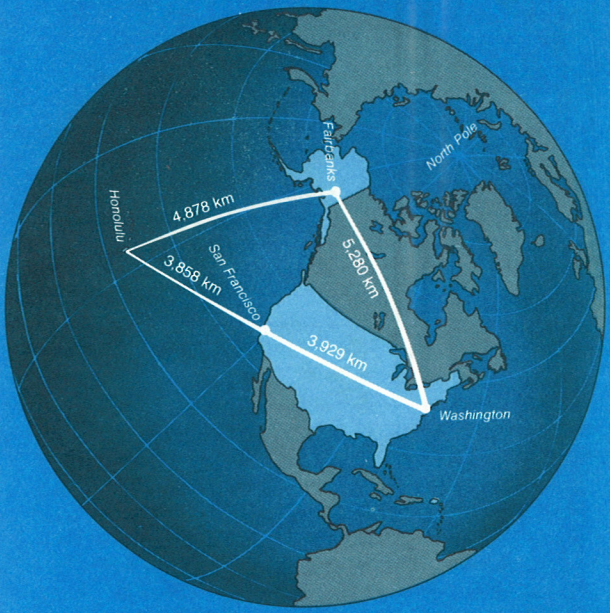
NGS

The National Geodetic Survey

1807-1980



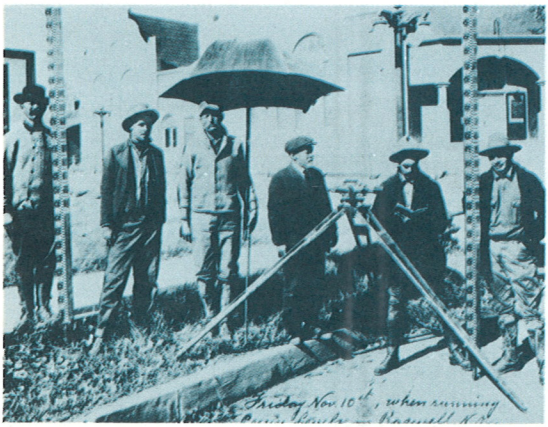
U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Survey

The First Scientific Agency

Surveying was to play such an important role in our Nation's development that the Government's first civilian scientific organization was an agency known as the Survey of the Coast—a direct forerunner of today's National Ocean Survey.

Anticipating the need for better navigational charts and improved coastal mapping to assist the young country's waterborne commerce, President Thomas Jefferson established the Survey in 1807.

Today, within the Commerce Department's National Oceanic and Atmospheric Administration, the National Ocean Survey produces millions of copies of a thousand charts of our Nation's coastal and inland waterways, and its surveys span the continent.



Although early U.S. surveys concentrated on coastal areas, as the nation expanded westward the need for surveys of the interior regions became apparent. Development of the national geodetic control networks paralleled national growth. A horizontal control network was established to provide latitude and longitude, and a vertical control network to provide elevation. These networks provided the basis for mapping, charting, boundary demarcation, and large scale engineering projects—railroad and highway construction, dams, irrigation, and inland waterways. Although these uses remain relevant today, space-age science and socioeconomic concerns require even more precise geodetic control.

Changing Elements

Legal, environmental, and political factors also affect the need for accurate control in urban areas, regions of natural resource development, coastal zones, flood plains, and earthquake hazard zones.

Today, the geodetic networks consist of approximately 250,000 horizontal and 500,000 vertical control stations that are the responsibility of the National Geodetic Survey (NGS), a major element of the National Ocean Survey.

The spacing and accuracy requirements of these networks involve coordination and joint planning efforts with other Federal agencies. In conjunction with the Federal Geodetic Control Committee, NGS ensures that surveys funded by the U.S. Government are incorporated into the National Networks of Geodetic Control whenever practical. Cooperative agreements between NGS and other Federal, State, or local agencies stipulate that necessary Federal requirements are met, along with meeting local needs.

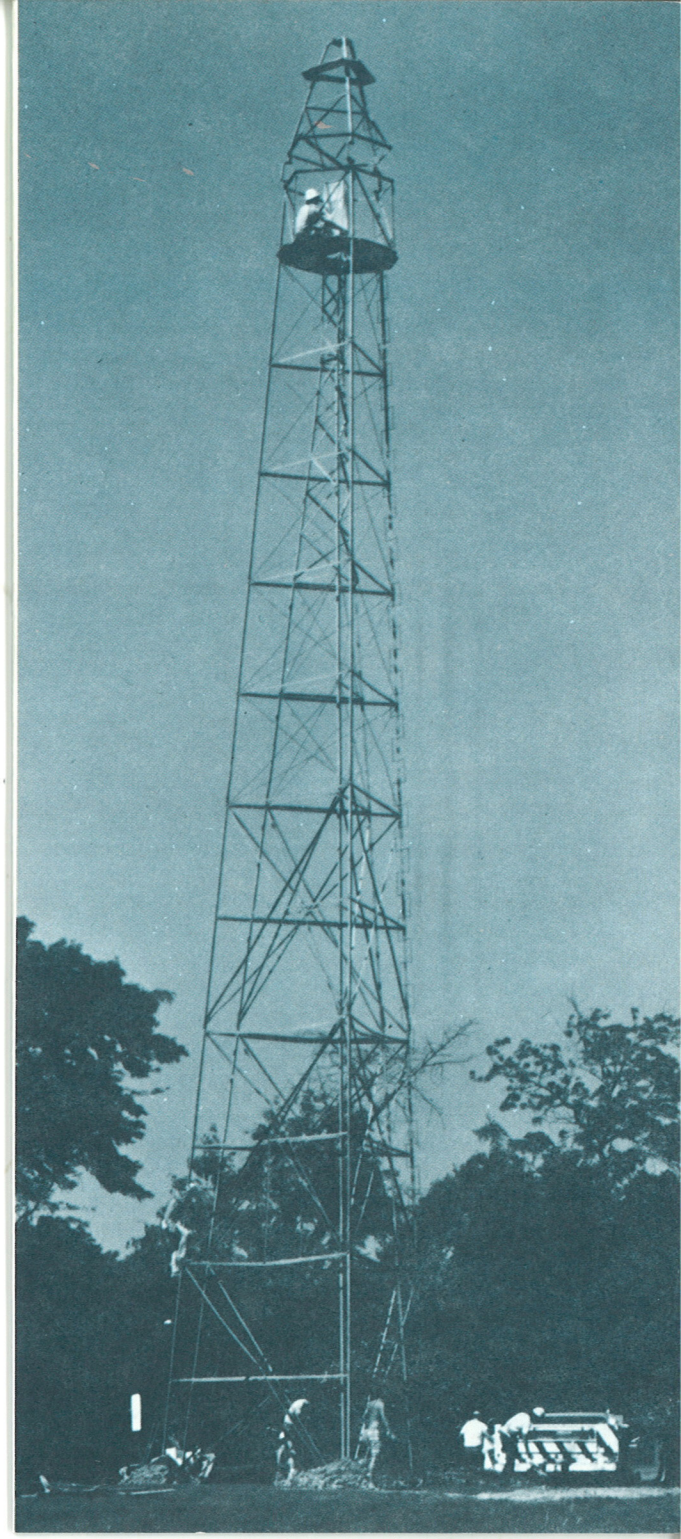
Special purpose surveys are sometimes planned to meet specific requirements. A recent example was a joint project between the National Geodetic Survey and the U.S. Geological Survey (USGS) to probe crustal motion in Southern California in support of the USGS earthquake hazard reduction program. This project involved precise leveling and gravity observations along 4,000 kilometers of selected routes, and eventually became a cooperative effort also involving Ventura and Los Angeles counties, the Los Angeles Water and Power Department, and the City of Los Angeles.

Data Acquisition

The National Geodetic Survey conducts field surveys of various types to establish geodetic control and obtain other specialized field data. In addition, NGS operates astronomic observatories in Ukiah, Calif., and Gaithersburg, Md., for the determination of a phenomenon known as polar motion.

At its facility in Corbin, Va., NGS tests and evaluates new instruments and equipment, modifies existing equipment, and designs and fabricates equipment of a specialized nature that cannot be obtained commercially to enhance the accuracy and reliability of modern geodetic surveys.

NGS operations personnel assist State and local governments by providing advice and training in the performance of geodetic control surveys to meet



their needs. Through the network maintenance program, NGS solicits the cooperation of Federal, State, and local governments, and private individuals to preserve geodetic marks. Also as a result of cooperative agreements, NGS has geodetic advisors in several States who work with State personnel to solve local geodetic problems.

Major Computer Task

After field observations have been made, precise computations are carried out in order to derive the best possible coordinates, elevations, and gravity values for stations in the networks. A major effort now in progress is the redefinition of the horizontal and vertical control networks for the entire North American Continent.

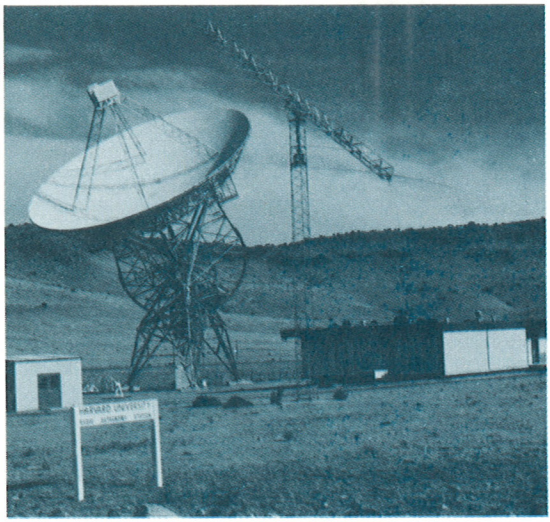
The new adjustment of the horizontal North American Datum (NAD) will culminate with the unprecedented simultaneous solution of a system of 500,000 equations in 500,000 unknowns. This necessitates one of the largest mathematical applications ever to be performed on a computer. The adjustment will result in new positions for network stations which will be placed in the NGS data base. The data base is designed to handle the enormous quantity of data and publish the computerized results. When the revised coordinates are published, the new datum will be known as the North American Datum 1983 (NAD83). This will be the first redefini-

tion of the NAD since 1927. The project spans Greenland, Canada, Alaska, the conterminous United States, Mexico, and the republics of Central America.

A parallel international effort is in progress for the readjustment of the National Geodetic Vertical Datum. This project will be accomplished over an 8-year period, involve over one million kilometers of leveling, and upon completion will produce a homogeneous set of new heights on a common datum.

Geodetic Research

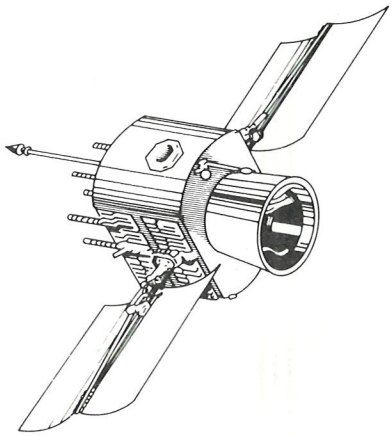
The National Geodetic Survey carries out research and development activities in order to improve geodetic techniques and extend the limits of geodetic knowledge. A major area of research is NGS' geodynamics program. The purpose of this program is to determine systematically the dynamic behavior of inland, coastal, continental shelf, and deep ocean areas of the Earth's crust. This will allow identification of stable regions and those subject to motion where human habitation, resources development, commercial activity, and environmental protection are involved.



NGS is making use of advances in space technology in its geodynamics program. For example, in order to determine more accurate polar mo-

tion and Earth rotation information, a method called Very Long Base Line Interferometry is being used. Radio signals received from extragallactic sources (quasars) are observed by pairs of radio telescopes and recorded (along with very accurate receiving time) on magnetic tape recorders. This project, called POLARIS (Polar Motion Analysis by Radio Interferometric Surverying), also will provide data useful in crustal motion analysis.

Crustal motion data are required for many purposes, ranging from siting nuclear power plants to determining areas of submergence or earthquake hazard. In the past, traditional geodetic techniques limited scientists to the use of historical data to identify local areas of crustal motion. With a new generation of instruments and space techniques available,



regional crustal motion occurring over large areas in a relatively short time span can be monitored.

Another area of research is the advanced positioning systems. NGS is investigating several advanced systems for geodetic applications. One is the Department of Defense's NAVSTAR Global Positioning System (GPS). GPS is a satellite system which is expected to achieve 2- to 3- centimeter accuracy for station coordinates anywhere in the world using several hours of observation time. Another is an inertial surveying system which may be transported easily by helicopter or land vehicle, and which can increase productivity of a surveying crew by a factor of 10 or more in performing local survey work. The use of precise photogrammetric methods for network densification is also being tested and evaluated. Technologies such as these will have a profound effect on the future of surveying.

Geodetic Data and Information Services

Each year NGS responds to approximately 20,000 requests from Federal, State, and local governments, and users from the private sector, for the following geodetic data and information services:

- Data for horizontal (latitude and longitude) and vertical (elevations) geodetic control stations with corresponding station description information.
- Geodetic control diagrams covering the conterminous United States, Alaska, and Hawaii.
- Gravity values for over one million points.
- Calibration Base Line Data.
- Astronomic and Doppler satellite data.
- Horizontal and vertical crustal movement data.
- Special services which include computer programs, historical records, publications, and related geodetic information.

Some of this information is available on magnetic tape or microform. For further information, contact:

The Director, National Geodetic Survey
National Geodetic Information Center, OA/C18
National Oceanic and Atmospheric Administration
Rockville, Md. 20852
(Telephone: 301-443-8631)

NOAA/PA 8002